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NOTES ON THE LIFE HISTORY OF LEUCANIA L-ALBUM, L.

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In view of what has happened during the last few years I cannot refrain from giving the following quotation from Barrett: "Forty years ago (1857) Mr Stainton, when recording the first occurrence of an allied species, made the unfortunate remark 'How long are we to wait for *Leucania l-album*.' A few years later some enterprising collector, considering that the time had arrived when the question should be answered, announced the capture, first of one, but afterwards of more, specimens in Kent. But the matter was carefully investigated by the late Mr H. Doubleday, and the whole transaction exposed." One wonders now whether these records were false. At any rate the insect did reach this country occasionally, for there were at least three taken before 1933, one at Sandown, one in S. Devon in 1901 by Eustace Bankes, and one at Eastbourne in 1909 by E. P. Sharp. The last was a female and laid eggs, but owing to lack of experience in breeding the rarer immigrant *Leucanias* most of the larvae died of disease. In A. M. Longhurst's collection there was a worn specimen labelled Hampton and placed in a series of *comma*.

In 1933 G. W. Wynn took three specimens at sugar near Dartmouth in September (*Entomologist*, 1934, lxxvii, 9) and F. Pennington took one near the Lizard (*Entomologist*, 1933, lxvi, 271, and 1934, lxxvii, 15). In 1934 S. Pooles took one in Kent (*Entomologist*, 1934, 237). In 1936 Wynn reported that he had taken it every year in his original locality in July or in September or in both months, and so proved that it was breeding in S. Devon. At the Annual Exhibition of the South London Entomological Society G. A. Cole showed a male taken at ivy bloom in Devon and B. Kettlewell showed a very large number taken at sugar on the S. Devon coast to the west of Wynn's locality. There appears to have been an immigration on a large scale from Kent to Cornwall in 1933 or a year or two earlier. The immigrants may have been unusually numerous and the weather for the next three years exceptionally favourable, but it is scarcely believable that in the last few thousand years there has never been a similar coincidence of an immigration of great numbers of moths and good weather during and after it. One may, therefore, anticipate that in spite of its successful start the species will eventually die out.

Spending a fortnight from September the 14th to the 21st and with the help of instructions kindly given by Dr Kettlewell I was fortunate in finding *l-album* plentiful and in good condition. It was astonishing to see two, three, and even four on a post. The moth comes freely to sugar and no weather deters it completely. A night, when heavy rain washed off most of the sugar, a full moon, and a sea mist did not prevent them from coming to the posts, though it reduced their numbers. The majority come early, between 8 and 9 p.m. (summer time) and after that only a few stragglers appear. They sit with wings horizontal and often quivering, but as soon as they have settled down they are quite easy to box. A few when they have nearly finished feeding, close their wings altogether. The moths were commonest where large clumps of a grass, identified by Mr Wilmot as *Festuca arundinacea*, were growing, and this is probably the grass preferred for ovipositing. Females

seldom come to sugar before they have laid two-thirds of their eggs, if one may judge this by their thinness, but now and then one comes, which is full of eggs.

I had anticipated that there would be a difficulty in obtaining eggs and tried stems of *F. arundinacea*, cut so that a piece of sheath was present, and also pieces of dead leaf with rolled up edges. These were placed obliquely in deep glass-topped tins with canvas at the bottom, and a ball of cotton-wool dipped in water or a dilute solution of sugar was added. One moth, chosen because it had laid about a third of its eggs, was placed in each tin. Very few eggs were laid in the green sheaths, but the narrower curled dead leaves induced all the females except one to lay. The eggs were laid out of sight in single or rarely double rows covered with transparent cement, which glued them to both surfaces of the leaf. I saw one female laying eggs at 9.30 p.m. and kept these separate. They hatched in 14 days, but I think some hatched more quickly, taking twelve days at the most. The young larvae eat their eggshells, and, from the fact that a few had intestinal contents and were larger than the others, some must eat an unhatched egg or two. After eating the shell they remain lying side by side and make no attempt to find fresh grass. To test this I left one batch undisturbed and they had not come out in a fortnight, though still alive. Mr Edelsten tells me that the larvae from the female taken at Eastbourne by the late Edwin Sharp hibernated after eating their eggshells without eating grass at all. I think this must be the normal habit, and that mine intended to do the same, but, as it did not suit my arrangements, I brushed the little larvae out of their hiding places and put them on pieces of the sheath of *Dactylis glomerata*. Separate pieces of the white part of the sheath were cut into suitable lengths and placed in small glass-topped tins with newspaper at the bottom, and the tins were put into a box heated by means of an electric light bulb kept burning day and night. This method was used successfully for breeding *L. vitellina* and *L. albipuncta* (*Ent. Record*, 1936, xlviii, 25) and gave a temperature fluctuating between 74° and 84° F. For the first two instars they fed gregariously hiding inside the pieces of cut sheath and after that fed openly on the green leaves which were substituted, only hiding and collecting together when changing skin. They fed up with great rapidity and at almost the same rate. The majority of the eggs hatched between October 2nd and 4th, and the larvae went down into damp peat moss as follows:—20th October, 5; 21st, 14; 22nd, 46; 23rd, 69; 24th, 35; 25th, 3—leaving one larva, which hatched on 6th October, and had been kept as one of the three controls. This went down on 26th October.

G. W. Wynn (*Ent. Record*, 1935, xlviii, 14) gave a short description of the larva, which I supplement with a more complete one.

First instar. Head yellowish-brown without markings, ocelli black, antennae colourless. Legs pale grey with dark grey rings. Thoracic plate yellowish edged with darker brown. Ground colour grey at first, green after feeding, skin (seen under microscope) very finely pitted. Tubercles small and black, setae short and thin, spiracles white with black ring, circular. Pattern—a narrow red-brown longitudinal line runs down each side just internal to the anterior trapezoidal tubercle, leaving a pale dorsal line of ground colour. Between posterior

trapezoidals and supraspiraculars is a narrow red-brown line, and a much broader one fills the space between supraspiraculars and spiracles, and there is another narrower line running longitudinally just above legs and prolegs. First ecdysis after two days. Length 2.5-3 mm.

Second instar. Head pale yellow-brown with dark brown mouth parts. Tubercles small and black. Ground colour pale grey, dorsal area greenish and sharply demarcated from ventral after feeding. Pattern—dorsal line of ground colour with red-brown longitudinal line at each side running just internal to anterior trapezoidals; very thin paler one between posterior trapezoidals and supraspiraculars, then two more red-brown lines close together running parallel, one just above supraspiraculars, the other between them and spiracles, the latter broader; then another narrower line above legs and prolegs. These lines run across prothoracic and anal plates, which are almost the same colour as the ground. Legs and prolegs grey with black rings. Crochets pale brown. The larva is a semilooper and uses a silk thread in the first two instars. Second ecdysis after two days. Length 5.5-6 mm.

Third instar. Head pale yellowish-brown with two vertical irregular red-brown lines, one on each side of clypeus (front), and on each lateral aspect four narrower ones converging on the black ocelli. Between these and the anterior lines are faint broken vertical striae. Legs colourless, grey at segments, prolegs pale grey with darker rings. Tubercles small and black with short pale setae. Ground colour white. Pattern—On either side of white dorsal line is a fairly broad dark brown line, in which anterior trapezoidals are situated, then a line of ground colour and external to it a very narrow longitudinal line, in which are situated the posterior trapezoidals; then two fairly broad lines close together, the lower, which touches the spiracles, is the broader; then a broad white stripe below the spiracles with a faint broken red-brown line running along the middle of it, and finally a fairly broad brown stripe running above legs and prolegs. In the mid-ventral line is a row of brown spots, one on each abdominal somite from 1 to 6. Third ecdysis after three days. Length 10 mm.

Fourth instar. Head pale brown, on each lobe a dark brown vertical line and external to it two very narrow irregular lines with lateral branches giving a reticulated appearance, then an indistinct broken vertical line, and on lateral aspect four narrow lines running down towards ocelli. Ground colour greenish white, becoming pale brown soon after ecdysis. Pattern, from dorsum to venter—a pure white dorsal line, then a very dark distinct longitudinal brown line, then a paler brown line edged externally with darker brown, in which lie the anterior trapezoidals. Then there is a pure white stripe running between anterior and posterior trapezoidals, then a stripe of medium brown, then a stripe of pale ground colour, then a light brown stripe edged on each side with dark brown, then a stripe of medium brown bordered by darker brown, running above, but just touching spiracles, then a whitish spiracular stripe with a very narrow and very light brown line running along the middle of it, then a medium brown finely mottled stripe just above legs and prolegs. Fourth ecdysis after three days. Length 15 mm.

Fifth instar. Head yellowish-brown with a broad irregular vertical stripe running down each lobe just external to clypeus, outside this is

a faint brown reticular mottling, then six narrow vertical lines converging on ocelli. Pattern—a narrow pure white dorsal line, then a very dark olive-brown line, then a light reddish-brown broader stripe with a slightly darker border externally, then a broad stripe of pale ochreous ground colour, then a medium brown stripe, then a pure white line, then a light red-brown stripe, clearer and redder than the other, edged with darker brown, then a pale ochreous stripe of ground colour, then a medium brown mottled stripe with a distinct dark brown line bounding it internally and externally, running just above spiracles, then a stripe of ochreous ground, then a very light red-brown continuous line, then a broader stripe of ochreous ground, and then a mottled band of medium brown running just above legs and prolegs. Fifth ecdysis after three days. Length 20 mm.

Sixth and last instar. Head yellowish-brown marked with brown only slightly darker; on each lobe is a broad vertical line running down on each side of clypeus, and external to this is another line in front and two lateral lines. Between the two lateral lines are two faint vertical lines with side branches forming a reticular pattern, a single similar line runs between the inner lateral line and the line down the middle of the lobe, and another between this and the innermost and darkest line. The outer edge of the labrum is dark brown. Pattern, from dorsum to venter—There is a thin white dorsal line with a dark brown line just external to it, then an ochreous stripe, covered with many broken wavy lines of dots, and bordered by a darker and more complete line, just inside which lie the anterior trapezoidal tubercles, then a stripe of bright ochreous ground colour. Next comes a rather broad brown stripe, at the inner edge of which lie the posterior trapezoidals. In one form of larva this is uniform in colour throughout, in another form on each somite from the metathoracic onwards that part of the stripe in front of the posterior trapezoidal is black or very dark brown, but intermediate forms occur. The rarest, as in *albipuncta*, is the form with no darkening of the stripe. Outside this is a narrow ochreous stripe, then a narrow brown line, then a slightly broader ochreous stripe, then a narrow grey-brown stripe, then a narrow greyish-white stripe, then a broader grey-brown stripe, touching the external edge of which are the supraspiraculars. Next is a pale ochreous stripe, then a narrow red-brown line, then a very pale ochreous stripe, and then a grey-brown band above the legs and prolegs. The whole surface is irrorated with fine wavy lines of dots. The pale lines run across the prothoracic plate and there the white dorsal line is widest. The spot on the mid-ventral surface of each abdominal somite is pale red-brown and very inconspicuous. The skin is very thin as in *favicolor* and *pallens*, thinner than in most Leucanias, and this accounts for the wet appearance noticed by Wightman and for the pale red intersegmental lines noticed by Wynn. The larva, when full grown, is more slender than that of *albipuncta*, and the head is yellower and smaller and the colour is redder in tone. One larva was most peculiar in appearance. There was no hypoderm at all on the dorsal surface and only small irregular patches on the left side and rather larger ones on the right, where the normal colour and markings were visible. The greater part of the skin was quite transparent and was grey in colour owing to the intestinal contents. Five days after the fifth ecdysis it is full-fed, and

very quickly empties itself of food becoming a pale semi-transparent reddish brown. It goes into the earth almost as soon as the gut is empty. Length 32-33 mm.

The larvae of *vitellina*, *pallens*, and *favicolor* dislike exposure to light intensely and quickly run for shelter, but those of *l-album*, *lithargyria*, *impura*, *conigera*, *comma*, and *putrescens* have no objection to it, and remain quite quiet in bright daylight, merely rolling into a ring when disturbed. That of *l-album* will even continue feeding, if it is taken out of darkness into full daylight. This difference in behaviour is not correlated with the difference in the genitalia noted by Pierce, for *comma* and *putrescens* belong to a group very unlike the others, while *impura* and *conigera* have a pointed cucullus and the rest have a rounded one. The build of the various larvae, and their patterns fit in neither with their habits, nor with the differences in their genitalia.

The larvae shrink remarkably before pupating, and the pupa is rather small. The first pupae were noticed six days after the larvae had stopped feeding, but they may have pupated the previous day. One undoubtedly took seven days to pupate, but when dug up nine days after entering the earth all had pupated. They make a small neat, but fragile cocoon an inch or two below the surface of the peat moss.

Growth was astonishingly rapid. The quickest larva took 18 and the slowest 20 days from the time they started feeding to the time they stopped, though the temperature of the box was kept between 74° and 64° and sometimes fell to 72°, which was much lower on the average than that at which *vitellina* and *albipuncta* were kept.

Some of the pupae were put into the warm box at once, others were kept at room temperature for a time and put into the box for forcing at suitable intervals, and the last 29 were kept at room temperature until the moths emerged. The first moths appeared on 8th November, 51 days after the eggs were laid, 39 days after the larvae stopped feeding, and 14 days from the time they pupated. Those not forced emerged from 9th December to 15th, having been in the pupal state from 40 to 46 days.

The females all looked very thin and I dissected seven, but no eggs were visible in the ovaries even under a magnification of 20, although two had been in the pupa at least 44 days. I suppose the rapid growth in the larval period prevented their development. Wightman (*Ent. Record*, 1935, xlvii, 60) did not force his larvae, and the larval period was 28 days and the pupal period 21 days. He obtained a pairing, but the eggs, 180 in number, were infertile. Wightman's moth had a longer larval life but a shorter pupal life than some of mine. Apparently three weeks longer in the pupal state did not make up for a week less in the larval state.

Almost all the imagines were darker than any of the wild ones, though a number of these were in bred condition and cannot have faded. There was, however, no difference in depth of colour between those forced from the outset and those kept throughout at room temperature. They were about the same size as those taken at sugar. Variation was slight. A few had a distinct red tint, and the brown in some was darker and more extensive than in others throwing the white L into strong relief. The L was narrower in some and its length varied, but

only two or three had a very short L, 2 mm. long in the shortest instead of 4 mm. in the longest.

No specimen of ab. *o-album*, Milman (Milman, P. P., *Entomologist*, 1937, lxx, 107, 287) was bred. The only two known, one bred by Milman and one caught by G. W. Wynn, came from a more easterly locality, where the insect is less common. If it occurs to the West, where mine came from, it must be extremely rare.

I feel sure that forcing the larvae is the best way of treating this species, for a friend, who kept his larvae at 55° to 60° F., wrote in mid December to say that his first larva had pupated about 12th December, while the rest were still feeding and were of all sizes.

A VISIT TO PORTUGAL.

By E. SCOTT, B.A., M.D.

I paid a short visit to Portugal mainly for the purpose of collecting butterflies from 29th June-16th July 1936. The spot selected, recommended to me as a very charming place for a holiday was Cannas de Senhorim in the centre of the country on the main rail route from Paris to Lisbon. It lies about 20 miles north of the Estrella mountains. The hotel Urgeiriça exceeded our expectations. It consists of an estate containing half a dozen bungalows or villas to each of which a party of visitors is allotted. There is also a central block in which lunch and dinner are served. Breakfast and tea are partaken of in the villas whither they are carried gracefully and efficiently on the heads of the native serving girls. The hotel was under capable management and catered particularly for English visitors. There is a good hard tennis court and a splendid swimming pool, very welcome after the labours of the day under a southern sun. I was accompanied by my wife and sister, and we were joined there by Mr and Mrs Richardson, who had travelled to Lisbon by boat. The latter was untiring in his pursuit of the Hymenoptera, while not disdaining Lepidoptera and Coleoptera. Our whole party was comfortably accommodated in a bungalow known as the Villa Mimosa. The surrounding country is undulating and the estate is situated in the middle of extensive pinewoods cleared in places for crops and vineyards. The trees of Portugal are many and various. The conifer is predominant, particularly the stone pine which has a very large cone and provides resin for which it is methodically tapped by the country people. The eucalyptus has long been established in the woods and the roads are bordered in places by Mimosa, Ailanthus, Catalpa, Arbutus and other beautiful species. The soil is sandy and the undergrowth consists of heath, genista, ulex, and 3 or 4 varieties of cistus of which a yellow, a rose coloured and a white are particularly common. The olive tree is extensively cultivated in the clearings. The flora is very varied and space does not permit a detailed description. Particularly common is *Lavandula stoechas* and *Lithospermum prostratum*. The heavenly blue of our rockeries is a common weed in the woods, where it blooms throughout spring and summer. Vetches are rather scarce. 1936 proved an exceptionally poor season for butterflies. The winter had been the longest and wettest on record. May had been fine but the first part of June had been cold and rainy and